

Regional Innovation Systems: Origin of the Species

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(Unedited version of *Liber Amicorum* contribution to Retiring Professor Louis Albrechts, KU Leuven, co-editor of *European Planning Studies*)

Introduction

In recent years, a number of editors of journals, encyclopaedias or handbooks, and critical reviews sections of spatial journals have asked me for recollections of how Cooke (1992), the apparently seminal article on the concept of Regional Innovation Systems, came to be developed. My non-selective memory of the ingredients here certainly involved KU Leuven, ISRO and Louis Albrechts. I was invited to give a lecture to the Geography Department at KU Leuven in 1981, where I met a young student, Erik Swyngedouw, and his senior colleague Louis Albrechts. Not long after the publication of Cooke (1983) I received an invitation to be a visiting professor at ISRO, where Louis Albrechts was already head. This lasted from 1985 to about 1990. During this time, we visited Jack Dyckman, the famous American planning theorist and gourmet, and his deputy Frank Moulaert and colleagues, at the Johns Hopkins Regional Research Centre in nearby Lille, France. This may have involved my first conscious, academic visit to an industrial district as Frank lived in Kortrijk (Courtrai) which was a traditional carpet cluster, the Kidderminster of Flanders. Jack hosted many excellent dinners at the *Brasserie de la Paix* in Lille where we planned two things: first we would begin doing regional research, especially on new industry activity in older industrial regions, and we would seed-fund it by seeking EU ERASMUS funding for research-based graduate training. Later, in 1991-2, Louis and I began the process that launched *European Planning Studies* where a number of articles on innovation and related regional and urban matters have been published.

In 1987, we placed a successful funding bid with ESRC for a project on '*High Technology and Regional Development in Britain and France*' which involved a comparative study of the computing and telecommunications industries in both countries.

This was successful and resulted in Cooke, Moulaert, Swyngedouw, Weinstein & Wells (1992) a book reporting our findings. In respect of the seed-funding that actually assisted my work to move from the regulationist emphasis of that book towards what became the concept of *Regional Innovation Systems* (RIS) was looked after most ably by Louis Albrechts who later led the successful bid to the EU for ERASMUS funding, which from the late 1980s, took the form of an Intensive Programme lasting two weeks each year with partners and programmes rotating among Leuven, Lille, Bilbao, Aveiro, Reggio Calabria and Cardiff. By 1993 I had been invited by my university to be founding Director of the new Centre for Advanced Studies, a post I hold to this day. Looking back, many important things thus evolved from these interactions as we shall see. For myself, the project was the first European high tech comparative one I had engaged in, and a test bed for the numerous innovation projects and articles, monographs and books arising from our future EU and ESRC funded innovation research which assisted the refinement of the original Regional Innovation Systems framework alongside many valued research partners and their case regions. The Cooke-Albrechts partnership also led to *European Planning Studies* a journal I was particularly keen to introduce not least to showcase the many high quality regional science, economic geography and related spatial policy articles that were ‘locked-in’ to their own language communities and the research on which they were based deserved, in both our opinions the widest possible audience. Finally, the ERASMUS funding, tiny by comparison with later seven-figure research contracts, allowed all-important research experimentation out of which as will be shown, the evidently useful academic and policy concept of Regional Innovation System might evolve.

Origin of the Species

Anyone of the relatively few reading this who was an instructor on the ERASMUS Intensive Programme or the larger number who were graduate students (of which there were usually between 20 and 30 each year) will remember a vivid experience in which student sub-groups opted to pursue one of four projects. My group, usually in partnership with one of our Basque partners, focused on regional innovation networks and policies. Workshops, reading and literature review write-ups were followed by research design,

methodology, drawing up of survey instruments, documentation and setting up interviews with firms, regional agencies, innovation intermediaries and research institutes. Then we all scattered to conduct interviews and gather further secondary material, notably from Lille's Cité Scientifique *Technopole*. The final stage was project write up as a project report and presentation at a final collective workshop. The first few of these in which I was involved took place in Leuven and Lille successively. The first one stays in the mind as a successful experiment that showed such a venture could be successful and enjoyable pedagogically for all concerned, but the second one was memorable for the detail and depth of the results we got on the Nord-Pas de Calais *système d'innovation régionale* as we called it. Whether because that is what we heard or because it was easier to say it like that in the interviews which were nearly all conducted in French, hence my presence, is uncertain. Probably the latter, but anyway that, as far as I remember, was where the concept first emerged.

The best recollection of the results of that, the first properly designed RIS study to my knowledge, was published in Cooke (1993) in a rather obscure, geographical series from Greece called *Topos*, recording the proceedings of an international workshop held in 1992 on the island of Spetses, in the school building where John Fowles taught before he became a celebrated novelist. This was one of a series organised bi-annually in Greece by our academic friends from, mainly Athens and Thessaloniki, where in beautiful settings like Naxos, Lesvos, Samos, and Lemnos, the Greek government, at the behest of organisers like Costis Hadjimichalis, Dina Vaiou, Grigoris Kafkalas and Panos Getimis, amongst many others too numerous to mention, would subsidise our *international* regional science workshops as long as they were done within reasonable proximity to Turkey. This underlined and symbolised – at the time – the important *international* not simply local activities sustained in the Greek periphery and were a kind of reminder of that status in these sometimes quite heavily militarised border settings. Thus by day we conferred and by night discoed in defence of the Greek realm. In a later meeting, organised slightly tangentially on this occasion by regular island workshop participant Hatto Fischer, we found ourselves conducting a roadshow of 'workshops' in Crete. The model for this was 'creative regions' by day and 'poems and pints' by night in the

company of such luminaries as Irish bards Brendan Keneally and Paddy Dorgan, alongside, amongst others, a remarkable and operatic Bulgarian *diva*, all funded by their government international arts programmes. Line-ups for daytime and night-time events would be supplemented by local expertise, whether archaeological, ethnographical or urbanistic by day or poetic and choreographical by night. Raki, zaziki and various other delicious exotica were our daily recompense for providing this remarkable service from one end of Kriti to the other.

Imagine our surprise and, for some, anxiety when being hosted by the Mayor of Chania at a proper dinner at the harbour, we found we were not alone but sharing the dinner with another and larger party. As we proceeded to eat and discuss who this other besuited party might be, since we had neither been introduced, informed nor expected to be sharing, some of our Greek friends made discreet inquiries about the identity of our co-participants. On hearing that it was a delegation from Serbia, at that time - 1995 - at war with its former Yugoslav neighbours, the poets in particular got up to leave. Ireland's neutrality in relation to the Balkan wars meant they were jeopardising the good name of the government they were representing. A formal letter was written and protest registered prior to our mass walk-out. This caused a row, which reverberated at least until the following day, when I along with Hatto's wife Anna, an employee of the Greek spatial planning division of the government were harangued by a member of that very government in mid-air as the two of us returned to Athens. We had discovered that arms were shipped secretly to Serbia through Crete, with Chania a port active in the trafficking, and the hosting was an official acknowledgement of the value of the trade for the port as well as an expression of solidarity between fellow Orthodox religious communities. Curious how the early exposure of peaceable notions like 'innovative and creative networking and systems' should involve us in such cloak-and-dagger interactions.

I am sometimes reminded, reflecting on these Balkan experiences how ancient trade and cultural connections can be as profitable as any high-tech planning efforts, if not more so. Crete was at that time evolving its 'Silicon Valley' having established ICT and

biotechnology research institutes, also having attracted returning Greek scientific migrants who had worked in the eponymous US cluster, but my guess is that more profit was made from the Byzantine processes of gun-running than anything coming out of the newly seeded laboratories. We see this today with the sudden rise back to prominence of the older resource-based economies like Australia and Canada prospering from the massive increase in demand for minerals and fuels from the likes of China and India. My interest in innovation arose from the very context into which I had been born and chosen to work. Wales had once been one of the world's early and great coal, iron and steel producers at the dawning of the industrial revolution. 95% of UK tinplate was produced at 'Tinopolis' (Llanelli) which was one of the first 'industrial districts' written about by Alfred Marshall (Marshall, 1918). Most American and Argentinian railroads were built with rails forged in the giant ironworks not far to the north of Cardiff, at Merthyr Tydfil, whose Dowlais works actually migrated to that coal port, the largest in the world where, in 1908, the first million pound cheque was signed by a coal merchant to pay for one massive shipment. When I have travelled by train from Hong Kong into China proper at Shenzhen, both before and after unification, I have been delighted to see at each junction the points controllers bearing the name of *South Wales Switchgear* a still extant circuit-breaker company that is now part of the Hawker-Siddeley aerospace combine. Much of world shipping was for a time fuelled by Welsh steam coal, the economies of France, Spain, Italy and other carbon-poor countries similarly. But this innovative region, which pioneered modern steel making through the Gilchrist-Thomas process was, in Marshallian terms, massively over-specialised and vulnerable to global competition and any downturn in world markets. After the first world war this vulnerability was realised and a 'long emergency' of slow industrial decline began – with, crucially – no significant back-up. This, of course, was the essence of the Marshallian industrial district and remains so to this day in those industrial monocultures that still survive in, for example, parts of Italy. Except, perhaps, even if they may often be based on, for example, engineering applications, they occur in variety between clusters.

Understanding and making hopefully intelligent alternative regional development proposals about improving regional developmental capabilities has thus been my main

intellectual interest and professional activity throughout my academic career. It now seems to me that the whole of the Industrial Age was constructed on the basis of a mistake. For the problems that interested me were by no means unique to Wales, but repeated with remarkable similarity throughout many such industrial monocultures. But, worse, the ending of that era was also constructed on a possibly larger mistake. Mistake one was over-specialisation and mistake two was over-diversification. For new industries were eventually attracted in to mop up underutilised and therefore cheap labour, but typically they were totally unrelated to what went before. I noted this in relation to the restructuring of the Belgian Limburg coalfield region in Cooke (1983), Genk in particular. I surmise that such was the surprise that, in those days, a remote Atlantic-facing and obscure Welsh academic should even know where Genk was, that it may have assisted the process by which a couple of years later I had been appointed a visiting professor in Louis' ISRO graduate centre.

Of course, once there for the 1985-90 period, I visited not only the Limburg coalfield to observe the foreign direct investment (FDI) platform, importantly focused on automotives, as had also been the restructuring 'strategy' in other declining coalfields in UK, Germany (Ruhrgebiet; Saarland) and Nord-Pas de Calais (Valenciennes), but most of Flanders' exquisite cities. Invitations were regular to Louis Albrechts' family home, a mine manager's house in the shadow of Limburg's then-remaining coal mines near the aforementioned Genk, but also to Erik Swyngedouw's home in Leuven and, in Brussels, Chris Kesteloot's loft in Rue Potagers in the heart of the little Istanbul of Brussels, where sheep brains on toast were a local breakfast speciality. Not infrequently, meetings took place in Brussels' then less-touristic, art deco *Mort Subite* bar. This place, now memorialised in the name of a Belgian beer (*Mort Subite* means 'sudden death') also then lent its name to this group of Flemish radical economic and social geographers when they published a good political economy manifesto for Belgium, to which Ernest Mandel, a doyen of the European new left contributed, if not actual content then verbal input to its production. Ernest always managed to be absent on my visits, so my copy of *Late Capitalism* remains un-autographed. Other accompanists on these Flemish field visits

included Pierre Van Wunnick, Pascal de Decker and the current book reviews editor of *European Planning Studies*, Guy Baeten.

Naturally, I improved my knowledge of regional development processes enormously from these annual encounters and from finding accessible numerous conference papers and actual publications that I encountered for the first time, for example GREMI papers. It is not impossible in the early 1980s that only one other Brit, David Keeble, who was a key member of the *milieu* network from its earliest days, knew of the existence of GREMI, although the late Rick Gordon, an Australian based in the University of California, Santa Cruz would be at least the other Anglophone. I have written elsewhere about Rick's role in a period of my intellectual development when I first got involved in researching biotechnology in 1985 (Cooke, 2007). However, these were pre-RIS days but only just. I had begun to get serious about innovation as the missing ingredient underpinning the two mistakes of phase 1 and phase 2 capitalism, and got a scholarship to study it in 1983 in Mitterand's France, specifically the *Maison des Sciences de l'Homme* on Boulevard Raspail, Paris. At that point in time, the Mitterand regime had introduced both regions and regional innovation centres, so for me it was the place to be. Unfortunately, at the time la Maison was in the grip of Althusserian Structuralist Marxism and it proved difficult, to say the least, to interest the likes of Jean Lojkine, my *patron*, in the study of a process that might actually save *Late Capitalism*, rather than bury it. For those not in the grip of the Althusserian winter, Bourdieu and Touraine for example, the range of my studies of the role innovation in the Industrial Age was perceived as ridiculously short by the former and narrow by the latter. So I spent a lot of time reading in the excellent library on Raspail, note taking and forming my reportage to my UK sponsor (later published as Cooke, 1985), then called the Social Science Research Council, later re-named by Maggie Thatcher's political guru, Sir Keith Joseph, the Economic & Social Research Council because obviously there could not be such a thing on this planet as 'social science'.

Some of my downtime was spent in Rue de Buci's excellent *Le Mazet* bar, now sadly transformed into an Eengleesh Pub. Among the luminaries I met in that home from

home for British buskers and journalists were, on the one hand, Felix and, on the other, Rudy. The former was a professor of English Literature at the nearby Sorbonne; the latter had been a mercenary in Angola. Felix, it transpired, was a refugee from Franco's Spain whose family home had been in Cadiz. Interestingly the family, although as will become clear, bourgeois, was Republican not Fascist so they upped and left for Paris. On inquiring in my not bad French of those days how Felix, a Spaniard, had reached the level of scholarship in Eng. Lit. to be a Sorbonne professor, his response was the alarming one of 'which part of Wales do you come from?' When I told him, not thinking he would have heard of anywhere but Cardiff, whose Arms Park had hosted numerous defeats of the French rugby team during the Welsh 'golden era' of the 1970s – the influence of which, astonishingly, had extended to the naming of one of the chicest boutiques on Boulevard St. Germain *Cardif*, I mentioned the eponymous city as my current domicile. 'Of course, I know it well. Do you know the Cory's?' This was only the name of historically the second biggest mine-owner in the Rhondda, whose Dyffryn estate in the wealthy Vale of Glamorgan I only happened to have visited because it had become a publicly-owned conference centre after coal's nationalisation in 1947. 'I used to spend my summer holidays in Dyffryn every year as a child. Marvellous library. Lots of reading.' It transpired that Felix's family had once been Spain's main coal importing company – so Cory Coal came from *Cardif* to Cadiz, I said, alliteratively, trying to display a little poetic nuancing, which he quite liked. 'Ah, the poetic Welsh, even the coalmen used to speak in rhyme at Dyffryn.' he said.

But on a further occasion, a more sinister turn occurred in our conversation. The largest mine-owner in all Wales was the Marquis of Bute, who owned numerous coal-bearing valleys and three-quarters of the land on which Cardiff was built, through marriage into the Norman-Welsh Herbert family, also Earls of Pembroke. He had re-built Cardiff Castle hiring top pre-Raphaelite architect William Burges to re-design it as a neo-medieval fantasy that still graces central Cardiff as, nowadays, another public 'experience' destination. Crichton-Stuart was the Scottish family name and Catholic the religion. I asked Felix if he had heard the story that I had never seen checked historically but was common currency in the city, that when Bute transformed his Cardiff land

holdings into Great Western Groundrents in about 1935, selling off some of the freeholds in the process, he sent £30 million to fund Franco's Spanish campaign, thus facilitating the Spanish Civil War. 'I have heard that too, and given the ideological struggle between owners and labour in the south Wales coalfield at that time, with the Communist unions replaced by 'scab' industrialist's unions, I could easily believe it, but I do not *know* it.' And there we left it.

Rudy was American and when I first met him had been working as a make-up artist in the French film industry in Paris in between stints in various local wars, at that time as a mercenary in Angola. He talked about doing Liz Taylor's make-up and how to give her an anxious, perspiring look, one sprayed her with a fine mist, off camera of course. Although for a *Metro* scene of panic this had to be done in the dark between stations, a recipe for all sorts of small disasters. He was good mates with James Baldwin and seemed to know half of the Parisian bohemian set. Before leaving America he had been in the music industry and had given the then top US recording band *Sad Café* the inspiration and, he said, many of the lines of their then hit record *Rudy*. By a strange coincidence I met him again later that year in a bar near Copenhagen's Central Station where I was sharing refreshment with Kevin Morgan, with whom I had been invited to a workshop in the university, where our aforementioned Greek colleagues would also be present. Into the bar limped Rudy complaining of excruciating back pain and clearly in great discomfort, also in army uniform. Assuming he'd been shot in Angola, I re-introduced myself and introduced Rudy to Kevin. 'Naw, not shot anywhere, I did this jumping out of the bedroom in *Le Mazet* escaping from the irate husband of an actress I'd been doing make-up for. Crashed right through that glass roof at the back of the bar. Anyway, in hospital I started writing again. Got some poems.' Which he proceeded to pull out of a huge kitbag. 'People I showed them to said they were excellent, wanna read some?' 'Who were they?' 'Well, they certainly included Felix.' I suspect Kevin thought I'd exaggerated about my Runyonesque interlocutors in Paris, so the scene was reminiscent of Woody Allen's *Annie Hall* when Marshall McLuhan arrives to correct his interlocutor in the cinema queue. At that time we were both interested in innovation and regional development policy and within a year or so had published a paper on

semiconductor industry innovation in *Regional Studies* (Cooke, Morgan & Jackson, 1984), the first in Europe, I believe. We still think of it as *for Rudy*.

So 1983 was an interesting year in the evolution of thinking that eventuated in RIS but it was Cooke (1993) that reported the first reasonably well-designed RIS study, facilitated by the good work of Louis in winning the Intensive Programme money that made it possible. The Nord-Pas de Calais study was one of six in the paper, the others being Baden-Württemberg, (whose RIS Kevin Morgan and I had begun researching from 1989), the Basque Country and Valencia (RIS research with friends Goio Etxebarria, Mikel Uranga, Ricardo Alaes and Arantxa Rodriguez having begun in 1988), Norte region, Portugal (researched with Artur da Rosa Pires, then my student, now senior in the University of Aveiro, following a stint as a minister in the Portuguese government) and Attiki region, Greece (researched with the help of Costis Hadjimichalis and Dina Vaiou, Grigoris Kafkalas and the currently – outrageously – incarcerated Panos Getimis). The last two organised the Spetses workshop and edited the *Topos* publication.

The Basque friends noted above were, of course, also partners in the ERASMUS network, and if anything, the Basque connection led to production of the most rigorous early study, utilising the same methodology pioneered in Lille. This was because the research was properly funded, the sample of firms was broader, the time at our disposal greater and the institutional set-up more manageable. There, unlike Nord-Pas de Calais, there were not a large number of small research institutes, and there were many fewer innovative firms at the time, only the governance framework was comparable with a regional government with relatively powerful ministries, and an innovation agency SPRI. But above all the six EITE (now *Tecnalia*) sectorally-focused technological centres and further six funded by the three provincial governments (Cooke et al., 1991) pointed to a rich innovation infrastructure. Here three key things were visible: first, how a deindustrialising region depended upon possessing intermediary agencies with innovation and industry expertise, independent of government (though part-funded by so-called generic project-funding disbursed by the Basque government) and of the then new and not significantly research active university sector. These would project Basque industry

into a new future different from the disappeared heritage of steel-making and shipbuilding. Second how *systemic* in terms of networking connectivity the whole and particularly some parts of the regional economy were, notably the Mondragon organisation, amongst the most innovative networks observable anywhere at the time. Third, how networks could sometimes take the form of ‘industrial districts’ or innovative clusters which, although composed of micro-firms and small-to-medium ones, could nevertheless exert global reach. Being dined in the executive restaurant of Danobat, one of the leading machine-tools manufacturers deep in the mountains at Elgoibar, we were interested to know that our fellow guests were executives of Japanese machine tools giant Toyoda (part of the Toyota group) ordering a customised flexible manufacturing system that was in those days ‘state of the art’.

The Network Paradigm Dimension

The idea of a ‘network paradigm’ for regional economic development was first articulated in Cooke & Morgan (1991; 1993). However, the network concept had been bubbling up earlier than that, particularly in relation to innovation networks, but not especially ‘regional’ networks in the discussion by Camagni (1991). Moreover, given the latter’s regional economic development credentials, credit is due in that quarter. Nevertheless, it is clear that Camagni’s colleagues in the Francophone ‘European Research Group on Innovative Milieux’ (GREMI) were approaching a discourse of regional development in *network* regions but without explicitly utilising that language (which in French is *résaux*) because of a preference for the rather vaguer notion of *milieu* (Aydalot, 1986; Maillat & Vasserot, 1986; Aydalot & Keeble, 1988). Curiously, in the last named, *industrial* networks but not *regional* networks are mentioned many times. What did *milieu* signify? It means medium or atmosphere, such as that which sustains us by enabling us to breathe, or water for fish, which performs an equivalent life-supporting function. More economically geographical, it is not that far from Marshall’s notion of the key to or secrets of industry, or in this context innovation, being ‘in the air,’ again a vague but irritatingly fascinating term that continues to be cited at least a century after he first articulated it (Marshall, 1890). Marshall, of course, wrote about, and in a way discovered, the secret of nineteenth century capitalism, which is that its division of labour

was highly selectively located in industrial districts that were, in modern parlance, suffused with network relations among entrepreneurs and employees. In this way, knowledge, or in Marshallian terms, *information* was in the air because it was the content of communication about technology, specialisation, labour processes, associated skills and their price in these constrained geographical spaces and industrial communities. Neo-Marshallian research had begun on highly networked, localised ‘industrial districts’ even before these *milieu* dates (Becattini, 1978; Brusco, 1982; Piore & Sabel, 1984).

The other main lineament of network regions, though regions were secondary to networks and innovation, arose in a much-cited special issue of the journal *Research Policy* edited and contributed to by De Bresson and Amesse (1991). This also ultimately harked back to Marshall but more from a Neo-Schumpeterian knowledge stream. ‘Networks of Innovators’ were the objects of interest, and many economic geographers, such as Storper & Harrison (1991), Saxenian (1991), Scott (1991), Lawton Smith (1991) and Glasmeier (1991) contributed. Perhaps only the second and fourth focused explicitly on regional networks as such. Freeman (1991) was more explicit, but less regional, in his review of ‘networks of innovators,’ as were Bianchi & Bellini (1991) on policy support for such networks. Nevertheless, through these interventions and the collection edited by Grabher (1993), such early awakenings to the notion of network interactions among innovators as a new understanding of the importance of geography to innovation, revealed economic geographers to be at the intellectual forefront of this burgeoning field. Economic geographers like Grabher himself explored the neglected social dimension in economic networks conceived by neoclassical economists as ‘asocial’, while in Grabher’s book, Ash Amin sought to show how globalisation was destroying regional networks, a peculiarly ‘northern’ perspective also later taken up by Coe and Townsend (1998) who stood on Amin’s shoulders in seeking to ‘debunk the myth of localised agglomeration’, at least in London, something that now seems recklessly heroic. This is not least given, for example, Grabher’s subsequent work on the advertising ‘village’ in Soho (Grabher, 2002). Another author whose name would be much-cited in the regional innovation and networks literature in subsequent years, Bengt-Åke Lundvall, also appeared in Grabher (1993) writing about co-operation in innovation activities among firms. So this early-

1990s era marks a break in the conceptual and real geography of innovation as smart entrepreneurial firms began running rings around large firms who, in turn, began outsourcing innovation to their supply-chains, which, as Klaus Semlinger, yet another contributor noted, were often highly regionally networked, especially in his native Germany, but also elsewhere.

Integrating Regional Networks and Regional Innovation Policy

The enthusiasm for studying networks remained in a context of manifest decline in the co-ordinating capabilities of states and markets regarding leading edge research and innovation, which subsequent data (e.g. Chesbrough, 2003) shows set in from approximately 1991. But if the central state had become as debilitated as many large private corporations were to become regarding the lack of productivity from their large budgetary allocations to research and development (R&D), the ‘regional state’ seemed from empirical reportage of the kind discussed above to be on the rise. A parallel strand of research had evolved, which focused on regional innovation policy (e.g. Antonelli & Momigliano, 1981; Cooke, 1985). Thus the connecting concept of Regional Innovation Systems evolved from this even earlier thinking about ‘regional innovation policy’, in relation to ‘regional innovation networks’ (the ‘systems view of planning’ intruding again). This happened in two publications, the more widely-cited one being less theoretically and empirically rich than the almost totally uncited one. The difference between Cooke (1992) and (1993) lies in the absence of any bibliographical influence from the ‘innovation systems’ literature in the 1992 paper, which thus has purer lineaments to economic geography. Contrariwise, the 1993 paper which shows the author had by then read Lundvall’s (1988) contribution on ‘innovation as an interactive process’ to Dosi et al (1988) and was also influenced by Johansson (1991) and Grabher (1991) in probably the first proper book on regional development from a ‘network regions’ perspective (Bergman, Maier & Tödtling, 1991).

It seemed necessary to place these distinctive ‘network and policy’ concepts in relation to each other in a layered model. So, the innovation policy dimension evolved conceptually into the idea of a sub-system supporting with knowledge and resources the innovative

firms in their networks. These formed a 'superstructural' sub-system dealing with actual innovation 'near market'. As we have seen, they had been spoken of as carrying out 'networking' with each other, not only laterally in alliances or partnerships and vertically in sometimes partly localised supply chains but also with the innovation policy and knowledge generation sub-system (Meyer-Krahmer, 1985; Cooke, Alaez & Etxebarria, 1991; Malecki, 1991; Rothwell & Dodgson 1991). So these also had sub-system characteristics related to the governance of innovation support. Each sub-system was also seen to interact with global, national and other regional innovation actors, and even through technological or sectoral systems of innovation. Open systems ruled.

Over the years the RIS framework has been analysed in terms of many different 'varieties of innovation' relating to localised, networked and hierarchical innovation 'governance' systems. Third Italy, Baden-Wuerttemberg and French innovative regions exemplified each, respectively. Correspondingly, the 'exploitation' sub-system of firms, in the main, could be dominated by large firms or oligopolies - even foreign ones as with the Asian transplants to Wales in the 1980s and 1990s. Other regions, like Catalonia had a mix of large (SEAT) and SME 'district' type innovation relations, while other places might have innovation regimes in which only small, entrepreneurial firms predominated, as in places with observable 'industrial districts', not only Third Italy but also some newer technology 'clusters'. Later still, these, more entrepreneurial SME systems, living by venture capital and exploitation of public research from universities, could be differentiated further as 'entrepreneurial' (ERIS), market-led systems, compared with those, especially in Europe, where they were more 'institutional' (IRIS) where state support was pronounced and 'entrepreneurship' was less advanced (Cooke, 2004).

The First Candidate Networked Regional Innovation System

Regional innovation systems are not really 'implemented' by policy but rather they evolve through processes of incremental and sometimes even quite 'disruptive' institutional change by markets and the institutional innovation support system. Hence, an institutional change such as the founding of a Regional Development Agency (e.g.

Scotland in 1976) that evolved quite a powerful innovation support regime, does not - even today - have a well-functioning 'innovation system'. Inter-institutional network gaps exist, and most SMEs do not function in fluent network relationships (Roper et al., 2005). Thus, having the innovation policy sub-system does not necessarily bring forth an innovative network firm sub-system, certainly not swiftly. By contrast, periodically Silicon Valley as an ERIS innovation model has shown excellent networking capabilities, not only among its manufacturing firms but its venture capitalists. But, until relatively recently, the governance of innovation displayed little meso-level intervention of the kind to be discussed below. In the past decade an *associative* organisation called Joint Venture: Silicon Valley has formed to promote civic entrepreneurship around education and the environment. Hitherto there had been no civic association or representative governance body for this high-tech complex other than Santa Clara County and the fragments of various cities into which it fell. The key networks were between firms, universities and the US Federal mandates such as defence, energy and healthcare.

Thus one reason why Baden-Württemberg (BW) is a candidate as the first regional innovation system is that its apparently modern style of network intervention by various institutions interacting with firms can actually be traced back to the nineteenth century Kingdom of Württemberg. Here, Ferdinand von Steinbeis established a pioneering vocational training system focused on the Esslingen locomotive works to train impoverished rural migrants in engineering because the regional economy of that time was too poor to sustain its population and hundreds of thousands, as elsewhere in Europe, were migrating to America. This was a 'seed crystal' of the idea that 'catch-up' with more industrialised (or today more knowledge-intensive) economies can fail to occur due to 'market failure': in which case third-party and, increasingly over time, state-intervention to design new sub-national institutional 'architectures' is justified. Normally national governments took these actions, but following the Thirty Years War and up to pre-unification Germany, sovereign governments were often scaled like regions or even city-states (e.g. Hansa cities) rather than the multi-level governance systems present in contemporary Europe.

Assessments of outcomes in the BW case were that during the balmy post-reunification economic times of the 1990s, financially stable and growing, its RIS worked well. In particular, new knowledge, especially from abroad, flowed through the institutional networks remarkably swiftly, not least because of the multitude of business associations, research institutes, intermediary associations (e.g. the Steinbeis Foundation) and chambers of commerce that held frequent seminars and workshops or keynote presentations for their members, who turned up, often in hundreds, to meetings on such topics as 'lean production,' 'systemic innovation' and 'flexible labour markets.' Problem-solving capacity, in which government was a partner, was accordingly swift, and innovation support measures or even innovative policy instruments were forthcoming. This seemed of the essence (Cooke & Morgan, 1998). But once the need for significant restructuring caused by sharp competition from Asia hit the institutional set-up, it could not adjust, as a classic institutional regional innovation system (IRIS), as swiftly as entrepreneurial innovation systems (ERIS) like Silicon Valley. There, 400,000 electronics jobs disappeared almost overnight, many more than were lost from the BW engineering platform, but by today Silicon Valley is well into its fourth or fifth disruptive innovation generation based on iPod and the semantic web. It is often said Google could easily have been envisioned in Europe - but it wasn't, and the reason why lies at the heart of Europe's innovation paradox. The EU produces world-class science but, often, minor league innovation.

The Well-Networked Regional System

An effective RIS is a self-organising, open system which translates 'exploration' knowledge from inside or outside the RIS, through a process of 'examination' of that knowledge to test and trial it for dangerous performance under stress conditions, to the point where it can be successfully exposed to 'exploitation' knowledge in the form of a commercial innovation on the market embodying new knowledge, whether scientific, technological or creative. Thus arts-based systems, though less-studied, can also be innovation systems - as Montmartre, Montparnasse and other points in 'fin de siècle' Paris, networked to other nodes in France and other 'art-cities' were (Lazzeretti, 2004). New York replaced Paris as the world's leading 'creative innovation system' in the late

twentieth century, and in this century, London seems to have risen, through 'Britart' to challenge New York. In each case, systemic institutional support (academies, conservatories) and, especially, associativeness among artists and their networks to dealers or, in music or literature, impresarios and agents, led to outpourings of creative product. A RIS functions through good transparency and openness between the knowledge generation or exploration sub-system and the knowledge exploitation sub-system, including nowadays what is perceived as practically a third, intervening, sub-system that translates the often tacit knowledge of the former, including from abroad, into primitive forms of codified knowledge for exploitation by the latter.

Increasingly, it can be seen that the 'innovation paradox' lies in this third 'intermediary sub-system' which in ERIS set-ups is occupied by knowledgeable attorneys or lawyers of various kinds, knowledge entrepreneurs who solve problems or seek solutions, financial engineers like venture capitalists, business angels and management accountants, and varieties of specialist consultants, incubator and accelerator managers, even well-functioning knowledge transfer offices in universities (Kenney, 2000). IRIS set-ups are slow and inflexible because markets for this talented kind of stratum are thin and largely absent so, through necessity, such functions are performed by unenterprising risk-averse government officials who do their best but cannot be effective substitutes. Research exploring these questions was generously funded in Canada from 2001 with the establishment of the Innovation Systems Research network led by Meric Gertler and David Wolfe.

RIS and Economic Transformation

Modern economies experience growth from successful competition against other economies and their constituent firms, especially when they demonstrate high absorptive capacities for usable, commercialisable knowledge. These generate productivity increases and the largest part of firm productivity improvements, hence regional productivity growth, comes from innovation. But markets fail, knowledge is asymmetric, there are knowledge monopolies and oligopolies. Nevertheless, knowledge, even patented knowledge, is largely a publicly available good if not always (e.g. in the case of payment

for a license to use someone else's patent) an actual public good. Because knowledge is public, asymmetric and monopolised it is incumbent on public and intermediary bodies to stimulate 'open systems' such as 'open science' and 'open source' software that in turn may facilitate 'open innovation' where large firms sub-contract knowledge generation of various kinds to smart SMEs or laboratories, rather than conduct R&D in-house. Countries are normally too large, complex and metropolitan-focused in that they generally favour asymmetric economic development in their capital cities and are ill-equipped to deal with the knowledge complexity of assisting regional knowledge capabilities. In such cases of 'government failure' regions are more than justified, indeed they have the imperative to assist in the moderation of knowledge asymmetries in ways tailored to the regional economic mix, which is always different from that of the metropolis. Networked regional innovation systems perform precisely this function. They enable the translation, import and diffusion of exploration knowledge that can enable innovation to be facilitated by those, mainly firms, which are responsible for knowledge exploitation. Increasingly, the translation of such tacit or implicit and raw knowledge into more usable codified or explicit knowledge is conducted by intermediaries who are 'complicit' with the implicit knowledge originator and the explicit knowledge exploiter. Most accounts of top venture capitalists show them having precisely this complicit capability where they recombine (*à la* Schumpeter, 1975) tacit, technological knowledge and explicit market risk and innovation knowledge through being complicit with both. So the third intermediating RIS sub-system is the repository of, mainly, complicit knowledge.

RIS are equally important in developed and developing countries. Although few developing country regions have them, by no means all developed country regions do either. Because of asymmetric knowledge problems only a privileged few regions even in the developed world have them. But in developing countries the 'lighthouse' RISs are in Cuba's biopharmaceuticals innovation system whose epicentre is the West Havana Scientific Pole, India's in Bangalore and Hyderabad's software and bioinformatics-based innovation systems, and Brazil's - mainly Sao Paolo's advanced bioethanol innovation system, that now even fuels the production of bioethanol with biofuels (Cooke, 2007).

China's economic take-off was not unconnected with Deng Xiao Ping's decentralising reforms after 1992 and China, like South Korea and Japan pursues RIS type strategies to a greater extent than hitherto, precisely to escape centralist 'lock-ins' that constrain regional innovation networks from evolving into systems. In developed countries RIS are growing in importance even in industries that organisations such as the OECD condemn as low-tech, notably the agro-food innovation systems combining biofoods (functional foods, nutraceuticals or plain 'healthy foods'), with conventional but scientifically-managed processed, chilled and hygiene-tested foods (Lagnevik et al., 2003), and organic foods utilising no chemicals or poisons in production. In regions like Skåne in southern Sweden, the innovation support system (schools, welfare and other public institutions) adopted a policy to be organic by 2012. In Zealand, Denmark the public food innovation consumption system targets at least 75% of the foodstuff used in the municipal kitchens and canteens to be organic before 2009. Both require that there is more attention given by firms to this demand before properly functioning agro-food innovation systems are in place. Since, in Sweden as a whole, 80% of total food demand is from public institutions, and in Denmark not much less, such a change in the agro-food innovation system profile will happen, or the conventional food industry is likely to fail in the face of cheaper competition from elsewhere for its dairy and horticultural produce (Rama & Alfranca, 2003). Most likely, the conventional agro-food production sub-system will adapt, as the supermarkets have, to the growing public and private demand for healthy, preferably organic food instead of the 'large footprint' produce that forms such 'placeless foodscapes' (Morgan, Marsden & Murdoch, 2006).

RIS and Policy

The most effective RIS operations can be influenced in co-ordinated markets like those of the Nordic countries by public procurement policy because the public sector accounts for such a large part of total demand. But it does not necessarily happen quickly. Thus the Skåne food cluster, generously funded by the Swedish Innovation Systems Development Agency, initially ignored organic food production and demand, even though its main municipality Malmö, is committed to a 100% organic school meals policy. Skåne's 'Food

Innovation at Interfaces' initiative favours emphasising the production of functional foods such as health drinks made from oats that purportedly improve the presence of 'good' intestinal bacteria. Such is the absence of scientific evidence that consumption of such drinks has any health gain effect on consumers that a new category of 'health claim approved' was introduced by Sweden's food regulatory body to recognise that a 'claim' for health gain had been officially been made, not that it had been scientifically validated. This 'innovation system' thus continues to favour biotech and conventional food over organic 'local food networks' despite well-documented evidence that much conventional food sold in supermarkets produces negative health effects, like obesity, let alone possible avian flu, salmonella, e-coli and 'mad cow' effects from its 'Fordist' mass-production processes (Cooke, 2007). Of course, these are by no means confined to Sweden, indeed Sweden's food regulatory system is exemplary and much better, as with all Nordic countries, than in liberal market US and UK. So maybe the 'spontaneity' of a tectonic shift in food markets away from possibly dangerous, conventional food and towards both public and private preference for chemicals-free, organic food in combination will prove strong influences on RIS network integration and synchronisation.

The most important policies to assist RIS development are to reduce political conflicts, especially where they concern human well-being, by establishment of an innovation culture that is inclusive, open and transparent to all actors and institutions in any given that interact in any way with innovation. In a process of problem-identification and policy-selection discourse related to innovation a clear consensus must be elicited for a regional policy vision, supportive associativeness must be animated and leadership from appropriate quarters - not mainly policy - must be mobilised and incentivised to achieve agreed actions swiftly and effectively. Policy should inform itself of the newly-discovered importance to economic growth of industries that are neither too specialised (like the alloy golf club head cluster in the Californian desert extolled in Porter, 1998) nor too diversified (can there be much truly innovative discourse between the neighbouring pig farmer and iPod manufacturer?) but characterised by 'related variety' where knowledge spillovers and absorptive capacity between industries are high in the lateral

dimension. The important task of regional innovation policy is to use the RIS to create platform policies for such integrated, rapid innovation-diffusing innovation 'platforms' (Harmaakorpi, 2006).

The onset of 'Phase 2 Globalisation' (Cooke, 2005) in which not only routine production and services but knowledge exploration, examination and exploitation are increasingly outsourced to China, India and other Asian countries more generally, means essentially one thing. With slight exceptions, these countries will remain for a long time at best incremental innovators but in the main, like Japan before them, mainly imitators. Schumpeter (1975) predicted this mimicry effect that 'swarms' in clusters as imitators pile into the market following the spawning of innovation. The West, especially the US will remain a significant, possibly overwhelming source of disruptive, even radical, innovation. The former is technology destroying, the latter competence destroying. Hence it is incumbent on Western countries to stimulate much 'related variety' in their economies, particularly of a thematic, rather than the old-fashioned, sectoral kind - thus security software, bioenergy, and human-computer interfaces with high-grade networking capabilities rather than the stale old ICT, biotechnology, nanotechnology trilogy highlighted in most national and sometimes regional science and technology prospectuses. Pervasive, platform-based and flexibly specialisable innovation is harder to copy than individual innovations like DVD and they are super-value-adding (i.e. the prospect of six innovations for the price of one). But there must be significant, especially increased private investment in the predominating sources of complex knowledge, the universities, and their scientists must be better-incentivised to innovate or network with innovators and complicit intermediaries, preferably themselves also as entrepreneurs if these RIS-based opportunities are to be seized. Good quality, well-resourced and globally benchmarked Centres of Research Excellence will be the key drivers of next generation innovation.

Countries and Regions Implementing RIS Network Strategies

At country level, Sweden, South Korea and Norway in 2007 had explicit, networked RIS building strategies orchestrated for regions by national innovation agencies. China also, as noted, has had a RIS strategy since the regional reforms of the early 1990s. Indeed China's exponential recent growth cannot be divorced from its RIS experimentation strategy, which, as noted, Deng Xiao Ping particularly made most explicit. Singapore, of course was an archetype 'top-down' RIS set-up first studied in Braczyk et al. (1998). Surprisingly, Japan has moved only a little in this direction, but will have to do more to escape its current condition of, in effect, economic stagnation. In Europe, the EU has tried to stimulate regional innovation strategies in over 100 regions but the results have been disappointing. Even Germany's BioRegio system-building strategy has only been seriously sustainable in Munich, already the county's main biotechnology cluster. The most interesting experiments are bottom-up as in Leuven, Belgium where 20,000 high tech jobs were created 1998-2006 by pursuit of a related variety platform strategy, and Lahti, Finland, which has independently evolved the same approach involving, for example, nanotechnologies in pervasive applications like energy, drug delivery and nanobiotechnology bacterial applications. These could be called 'third generation' RIS models, based on bottom-up experimentation, communication and leadership. They are more flexible and agile certainly than first-generation IRIS models and maybe even than sectorally specialised second-generation ERIS models. In a study of 11 candidate EU IRIS models in 1996-98 only four were found to have all the main IRIS elements listed above - the Basque Country, Wales, Baden-Wuerttemberg and Steiermark, Austria (Cooke et al., 2000). Of those, the first has performed well in the subsequent decade, the second has gone backwards in relative terms, though not absolutely, the third has stagnated, and the fourth augmented its economic performance. Steiermark, Flanders and SE Finland may be the best current technology-led RIS exemplars, while East Netherlands (centred on Wageningen), Skåne (despite its problems, it has great potential) along with cross-border Copenhagen forming the Øresund region, and 'Food Valley' the cross-border Basel-Freiburg-Strasbourg regional system are probably Europe's leading agro-food RISs. What such regions find is that 'network externalities' and their contribution to economies arise exponentially from a situation where if there is just one

computer or ‘knowledgeable’ actor in a territory hence they are zero, to a situation where if there are one million the externalities are incalculable. The more RISs there are to translate, transmit, and *transceive* commercialisable knowledge the more knowledge spillovers there must be and the greater opportunity for lateral absorptive capacity among, hopefully, RIS-supported innovative platforms.

Epilogue: Between Implicit and Explicit Knowledge

Recent regional innovation systems research conducted at CASS resulted in a paper (Cooke, 2008) that expressed suspicion that the utilization by geographers of Polanyi’s (1966) binary distinction between implicit and explicit knowledge has been rather uncritical. The concept of tacit knowledge as difficult to articulate in the absence of an interlocutor with a particular angle of interest on the knowledge she thinks the other has, but assumes it exists in an unarticulated form, nevertheless capable of being accessed, is considered rather powerful in explaining why geographical proximity remains so vitally important to modern socio-economic life. Thus why do most of us continue to live in cities when the Internet and Google exist? It is simple, the Internet and Google embody no capability for articulating meaning. The former is a passive cable while the latter is a probabilistic algorithm. E-mail may have more to offer regarding the extraction of tacit knowledge but even so, in the world of affairs face-to-face meetings continue to rise in number and intensity, even though tele-conferencing and video-conferencing technologies exist and are also increasingly utilised. Trade fairs and exhibitions grow in size and importance as places where tacit knowledge is presumably extracted and exchanged.

Codified or explicit knowledge thus clearly suffers from at least three problems that geographic proximity involving face-to-face and tactile interaction overcomes. First, it is not new. The process of codification is not instant; it takes time for analysis, construction, organisation and realisation in digital or analogue form. Businesses thus commission specific, exclusive and very short term projects from specialist consultants when they want much newer data than contained in , for example, official statistics. The World

Economic Forum actually supplies such a service, drawing upon specialist academic expertise, for its members because of this negative redundancy problem in a world economy in which innovation changes the utility of knowledge increasingly rapidly. Second, codified knowledge – even of the ‘swift knowledge’ kind just discussed is representative of a ‘mindset’, possibly a consensus from a committee, a perspective from a particular ‘school’, or simply the ‘conventional wisdom’ when what is needed is some superior approach or perspective to tackling a problem portfolio, particularly concerning the quest for novelty through innovation. Einstein is attributed the view that problems cannot be solved by the mindset that created them – something of which we are becoming increasingly aware as, for example, capitalism confronts climate change. Innovation frequently arises from ‘left field’ or to use a rugby analogy, the ‘blind side.’ Finally, codified knowledge is Foucauldian in the authoritative, ‘imprisoning’ manner of a decree. It is not, in itself, pliable but research, the handmaiden of innovation involves, as Latour (1998) puts it - uncertainty, risk, controversy, even subjectivity, in the sense of dissatisfaction with the status quo that normally triggers the innovative act.

Moving interactively among science and research as *exploration* knowledge, on the one hand, and innovation and entrepreneurship as *exploitation* knowledge, on the other is a moderately exact analogue of moving between implicit or tacit, and explicit or codified knowledge where raw, unformulated findings translate into concrete products available on markets. So *translation* is the key to innovation. But translation is not automatic; it is rather the exercise by a capable intermediary of *complicit* understanding and expression of the two ‘languages’ in question. Complicit in the sense of knowing the meaning of one kind of discourse and being capable of rendering it while retaining that meaning into another, different discourse. Of course, it is said that one definition of poetry is that which gets ‘lost in translation’ so it is not a perfect match but anyway this complicit and translational dimension is the missing element in the articulation of a full understanding of proximity-innovation articulations.

Now, what does the research reported in Cooke (2008) say about UK ICT and biotechnology clustering among proximate and distant network relationships involving

firms and organizations in relation to these issues. First, the paper anatomised a slice of the Cambridge biotechnology cluster (see also, Cooke, et al. 2007) where the university is mainly a locus of, on the one hand, research or *exploration* knowledge and transmission of science to students, in Latourian (1998) terms as codified, certain, detached and objective knowledge. But, on the other hand, noted the Wolfson Centre where ‘academic entrepreneurship’ is intermediated and research translation towards *exploitation* knowledge and codification by patenting, business planning and incubation begins. Then look it drew attention to one of the *bioincubators* which also *transfers* and *transacts* knowledge but is not necessarily its final commercialiser, where the firm remains supreme. It noted also the various either university or private seed-fund (e.g. Challenge Fund), business angel (Cartesia) and venture capital (e.g. Gateway Fund; Northern Venture Managers) intermediaries that must be *complicitly* capable of translating research findings into codified, fundable risk-managed commercial projects and ultimately profitable firms. We could go on, but space limits this interesting and novel discussion about the fact that tight geographical proximity is a *sine qua non* of *translational* practice because of the need for co-presence of the distinctive actors that bring reliable meaning to the fusing of tacit, complicit and codified knowledge through their shared, if asymmetrically so, knowledges. The paper also noted how many UK ICT firms located in their cluster even though they did not wish to collaborate with anyone. Why do they do this? Because, keep in mind rents may be three times higher than suitable accommodation nearby. When interviewed face-to-face firms said it was mainly to access knowledge spillovers like tip-offs about possible future innovation contracts provided by third parties, or equally third-party hints of human capital opportunities when a specific bright postgraduate is seeking a position. They have to ‘be there’ to access this complicit knowledge that they hope makes them enough profit to cover the excess ‘cluster rents’ and this knowledge is ‘in the air’.

So, tying together the main discoveries in this journey that began as early as 1981, inspired by reading McLoughlin (1969) while studying graduate school planning, the striking feature to me is the consistency with which the evolution of concepts which have involved me have also involved the intersection between theorising and researching the

intersections between spatial processes and spatial policies. This, of course is at the heart of the RIS concept, policies and research. Very recently, the concept's flexibility has been tested by application in traditional industrial, rural and 'green' economic contexts. The analysis works superbly well in these less science and technology or high-tech industry contexts. In 2007 alone, presentations have been made by this author on numerous occasions about, for example, the Rogaland-Stavanger (Norway) and Skåne, Sweden food innovation systems, the North Jutland agro-food, wind turbine and solar thermal energy system and home in Wales the novel agricultural products system (bioenergy, cosmeceuticals and functional foods 'platform'). Perhaps the most crucial lesson brought about by the rise of networked regions and RIS type architectures is that more and more firms and policy officials now realise that mere 'learning' is not enough and: 'To be innovative means no more copying'

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